User Manual

Bitalino

WIRELESS BIOSIGNALS S.A.

Title: OpenSignals User Manual - Bitalino

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WIRELESS BIOSIGNALS S.A.

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1. Introduction

Plux – Wireless Biosignals, S.A. creates innovative products for Physiotherapists and Researchers, by developing advanced biosignal monitoring platforms that integrate wearable body sensors, such as electromyography (EMG) and electrocardiography (ECG), combined with wireless connectivity and software applications to deliver real value recognized by its target markets.

OpenSignals is, then, the software responsible for the handle of all the data acquisition, visualization and processing while using Plux's biosignal platforms. The purpose of this manual is to introduce the reader on how to fully work with OpenSignals, exploring all its features and options. This version of the manual covers the OpenSignals version release for Bitalino.

2. Installation

2.1. Requirements

Operating System: Windows x86-32 bit**,** Windows x86-64 bit.

2.2. Installing OpenSignals

OpenSignals may be found online, under the following link:

OpenSignals 1.3.1 Core:

http://downloads.plux.info/OpenSignalsBIT/OpenSignalsSetup1.3.1.0.exe

Download the file, run it, and follow the instructions to automatically install the software on your computer.

2.3. Updating OpenSignals

OpenSignals is separated in two parts:

Core: OpenSignals "environment" with all the required libraries and secondary software, such as python and google chrome. OpenSignals **Core** is rarely changed and represents around 95% of the software size.

Source: OpenSignals "behavior" with the visuals and instructions. OpenSignals **Source** may be changed often. In terms of size, it represents the remaining 5% of the software.

Such separation allows us to automatically update OpenSignals, after installed on your computer, without disturbing your workflow or wasting your precious time. We do this by automatically downloading the last **Source** on software startup; due to its relatively small size (5% of software), you won't even notice it.

After downloading and installing the **Core** mentioned before (See *2.2 Installing OpenSignals*), an Internet connection is still required to download the last **Source**.

Whenever the OpenSignals **Core** is changed, it is up to you to decide when and if the new **Core** should be downloaded and installed (See *Figure 2.1*) – this is because it may take some time to complete. If you decide to install the new **Core**, wait until the download completes. When the download is completed, the setup is started for you; just follow the

installation instructions to automatically install the software on your computer. Again, an Internet connection is required to download the new **Source** for the new **Core**.

C:\Windows\system32\cmd.exe
C:\plux.svn\code\OpenSignals>chdir "C:\plux.svn\code\OpenSignals\"
C:\plux.svn\code\OpenSignals>"python27\python.exe" "code\main.py"
Updater: checking for updates... please wait...
Updater: OpenSignals core has been changed and needs to be re-installed...
Updater: would you like to download the new OpenSignals core? (Y/N)

Figure 2.1: Waiting for user command to: download the new **Core** or continue using the outdated one.

Even if you decide to reject the new **Core**, the last **Source** for your current one is still downloaded and installed.

3. Introducing OpenSignals

3.1. Welcome to OpenSignals

If the software was correctly installed, you should find an icon for OpenSignals: use it and welcome to OpenSignals!

Figure 3.1: Main page for OpenSignals.

From this main page, you have access to:

Acquisition: Real time acquisition of biosignals using a Bitalino. An in-depth tutorial of acquisition mode is given in 4. *Acquisition*.

Visualization: Previously acquired signals may be viewed here. For more information consult 5. *Visualization*.

3.2. File formats

OpenSignals uses two types of file formats:

Text file format (.txt extension): Holds information regarding the acquisition process (sampling frequency, sampling resolution and time/date), the device (mac address and device type) and, of course, the biometric data.

HDF5 file format (.h5 extension): Holds additional metadata like device events (digital output changes) and channel settings (sensors, gains, offsets, units and labels).

4. Acquisition

4.1. Real Time Acquisition Page

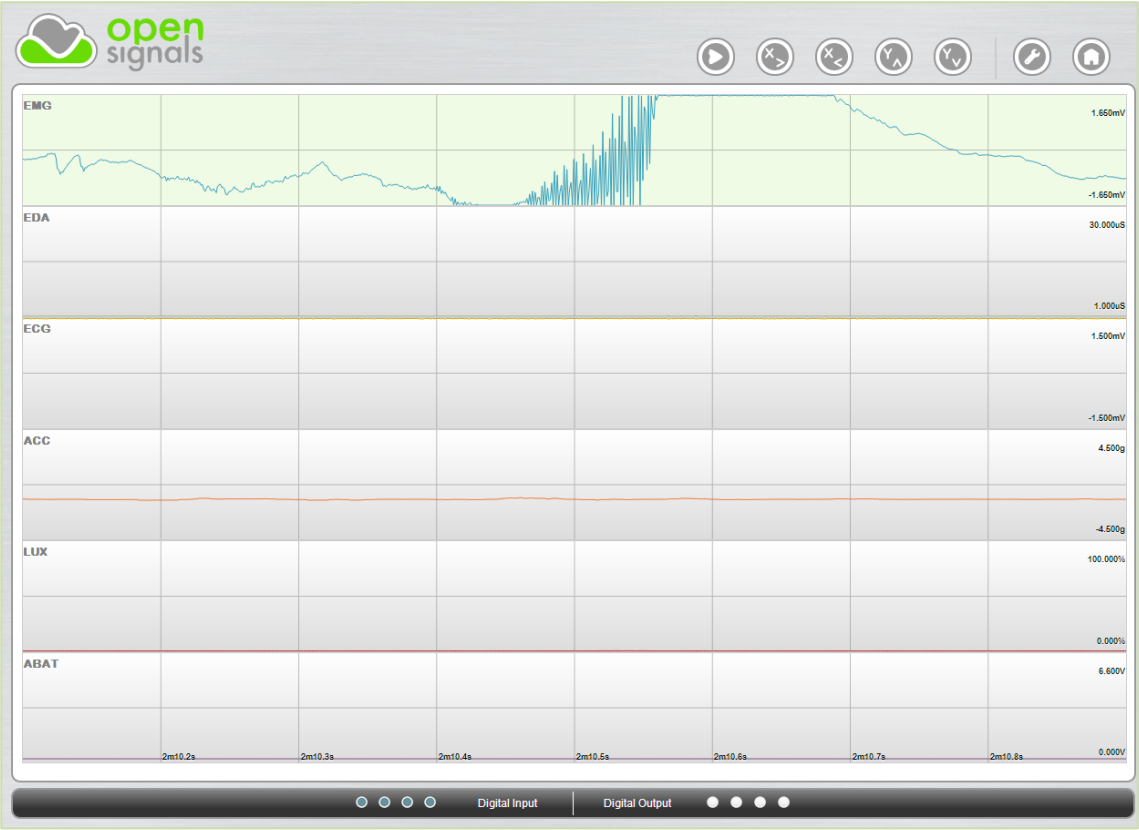

Figure 4.1: Acquisition page for OpenSignals

Accessing this page will open a connection with your Bitalino device and start retrieving the data in real time. The channels that are being acquired, its labels and conversion formulas may be configured in the configuration page (See *4.2 Acquisition Configuration Page*). The bottom of the page displays the 4 digital inputs that are being received and allows you to change the 4 digital outputs by toggling the respective radio box.

Additionally, it is possible to hide/show a channel by pressing its respective number on the keyboard or expand a single channel by double clicking it.

Button	Description
	Home button: Redirects to the main page.
	Configuration button: Redirects to the configuration page for acquisition.

	Y axis compress button: Reduces de Y axis range (Shortcut: Down Arrow).
	Y axis expand button: Extends de Y axis range (Shortcut: Up Arrow).
	X axis compress button: Reduces de X axis range (Shortcut: Left Arrow).
	X axis expand button: Extends de Y axis range (Shortcut: Right Arrow).
	Start/Stop button: Starts/Stops the acquisition

Whenever you stop the acquisition, a pop-up will spawn with the options to save you file. The generated filename will be composed by the *File Prefix*, *Tag* and *Timestamp*: {*File Prefix*}_{*Tag*}_{*Timestamp*}.h5 (See *Figure 4.2*). The file will be saved under the *File Path* directory. Both the *Tag* list and the *File Path* may be previously configured in the configuration page (See *4.2 Acquisition Configuration Page*).

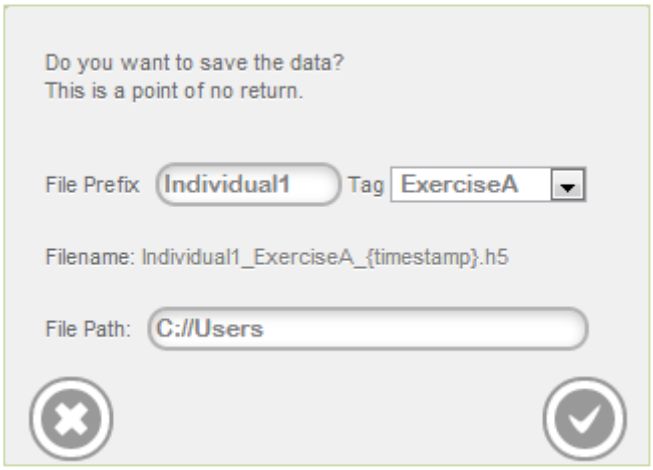

Figure 4.2: Data save pop-up.

4.2. Acquisition Configuration Page

This page is separated in 4 sub-sections (*Figure 4.3*):

Device identification: Contains the list of all devices added to OpenSignals and which of these devices is going to acquire once in the Acquisition mode.

Save to: The path on where the created files are being saved to. Additionally, it allows you to predefine a list of tags to better identity your files, define the file type and write comments to file.

Acquisition configuration: Acquisition properties.

Channel configuration: You can configure each channel in this section.

These sub-modules are explained in-depth on the next sections. All of your configurations are automatically and instantly saved upon change, so you don't have to worry about re-configuring your acquisitions and devices.

Using the *begin acquisition* button in the bottom of this page will redirect you to the Acquisition mode.

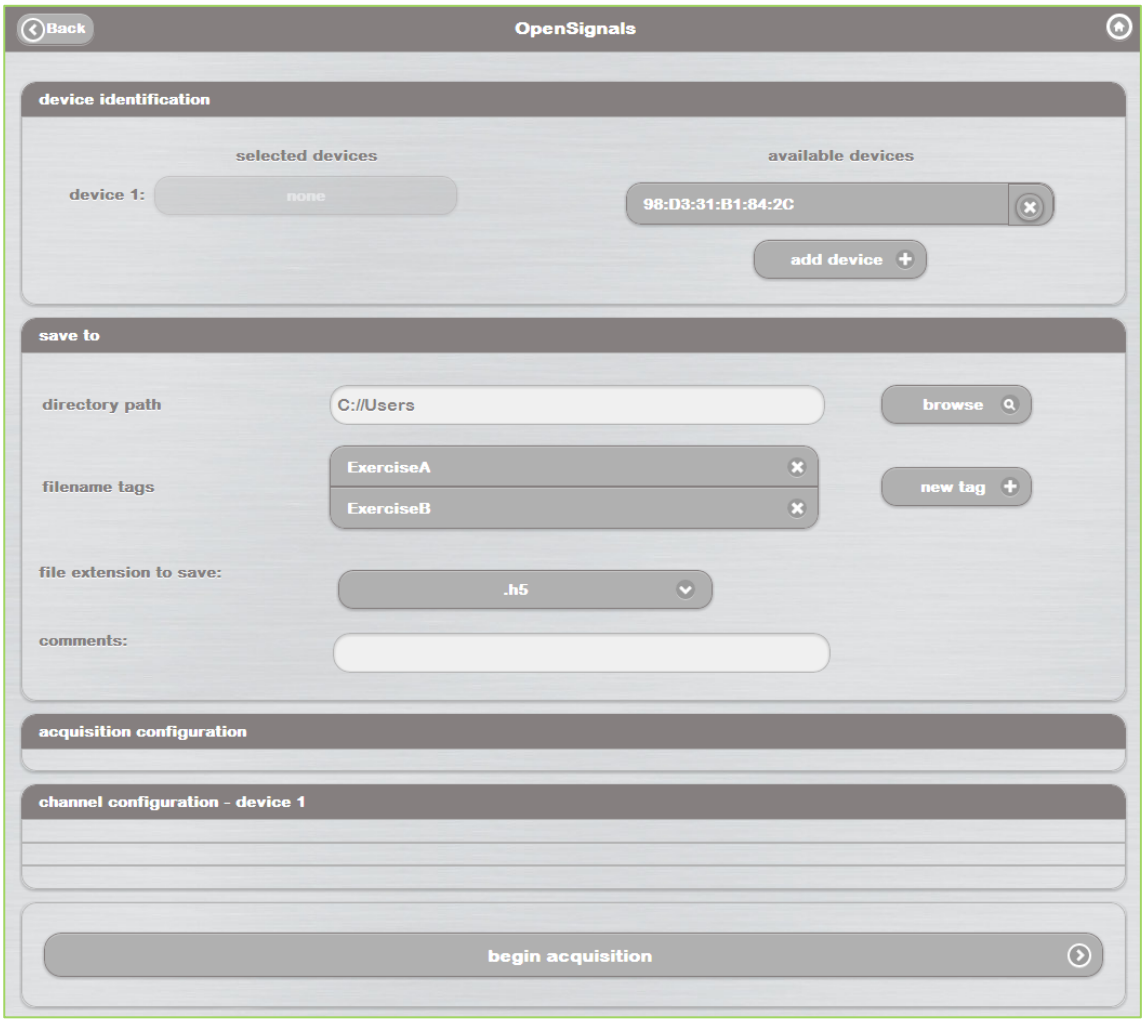

Figure 4.3: Configuration page for acquisition.

1.1.1. Device identification

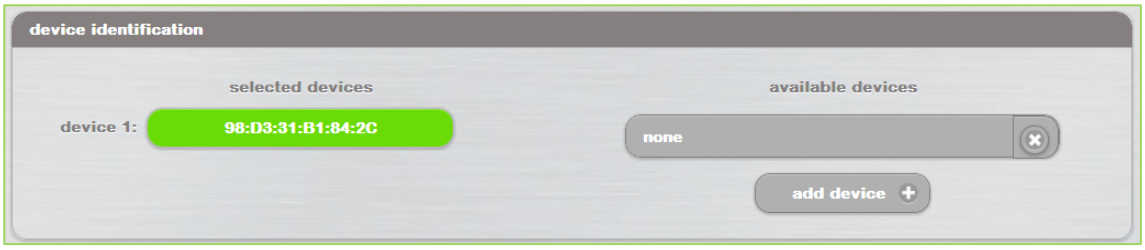

Figure 4.4: Configuration page for acquisition. Device identification.

On the right side of this section, there is a list containing your devices. Click over each one of them to select them for acquisition. To remove a device from this list, simply use the next to it. To add a new device, use the under the list; this will open a popup to help you search for nearby devices and attach new ones to the software (*Figure 4.5*).

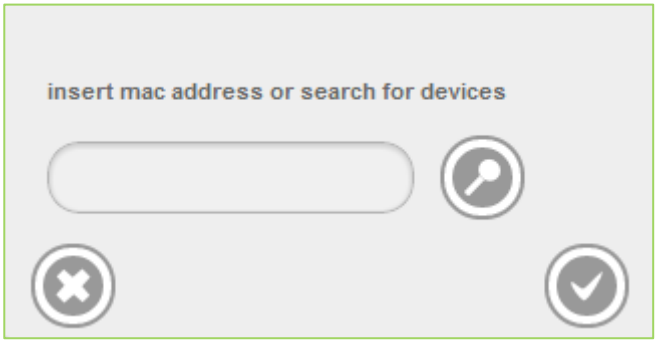

Figure 4.5: Configuration page for acquisition. Add device popup.

It is possible to either type in the mac address of the device or search for nearby devices and pick one. Use to check and add the device to the list or to cancel the action.

Since the device is a BITalino, it is required to pair the device with the computer before this step may take place. To do this, open the Windows Bluetooth device finder and search for devices in range. Pair with the BITalino using the pairing code 1234 (*Figure 4.6*).

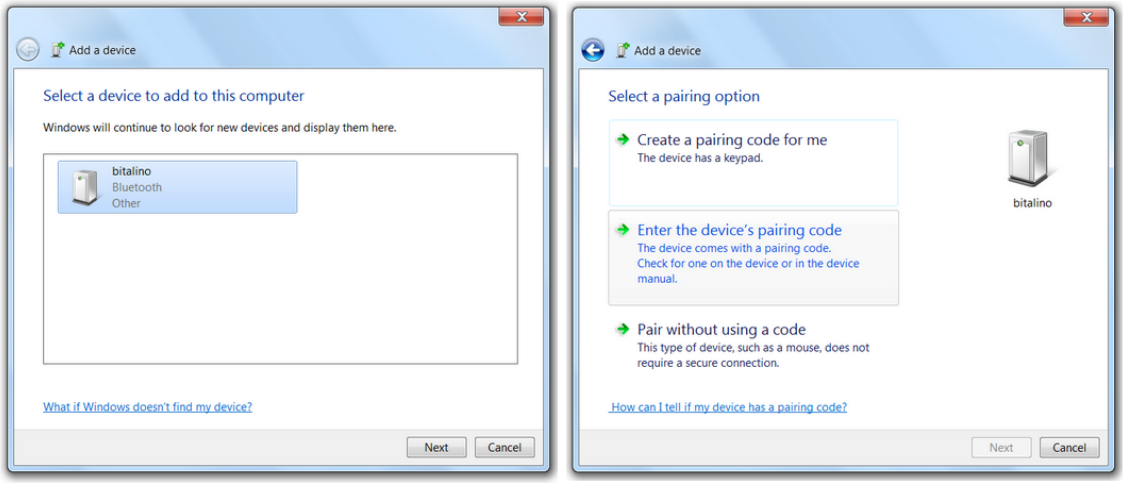
Add a device
Select a device to add to this computer
Windows will continue to look for new devices and display them here.
bitalino
Bluetooth
Other
What if Windows doesn't find my device?
Next
Cancel
Add a device
Select a pairing option
Create a pairing code for me
The device has a keypad.
Enter the device's pairing code
The device comes with a pairing code. Check for one on the device or in the device manual.
Pair without using a code
This type of device, such as a mouse, does not require a secure connection.
bitalino
How can I tell if my device has a pairing code?
Next
Cancel

Figure 4.6: Pairing a BITalino device with the computer.

Under *selected devices* is the device that will be acquiring once in the Acquisition mode. Clicking over it will de-select it and place it back in the *available devices* list.

1.1.2. Save to

Figure 4.7: Configuration page for acquisition. Section for tags, file path, file type and comments.

Directory path: The path to where the files created during acquisition are being saved to is set here. It is possible to either manually insert the path or use

to select a directory from the computer's file system.

Tag list: An editable list of tags that may be used during Acquisition mode to name the created files; such allows one to better identify each created file. Click over each tag to remove it. To add one, use

to open the popup shown below (*Figure 4.8*).

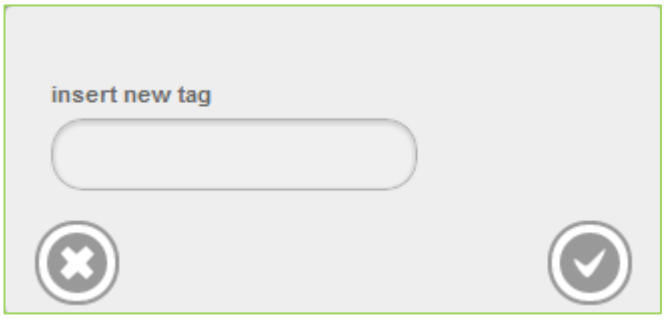

Figure 4.8: Configuration page for acquisition. Section for tags, file path, file type and comments. Add tag popup.

File extension to save: The extension for the files created during acquisition. Possibilities are .txt or .h5. More information on these options may be found at *3.2 File formats*.

Comments: Any additional information to be added to the file. It is only available when using .h5 extension files.

1.1.3. Acquisition configuration

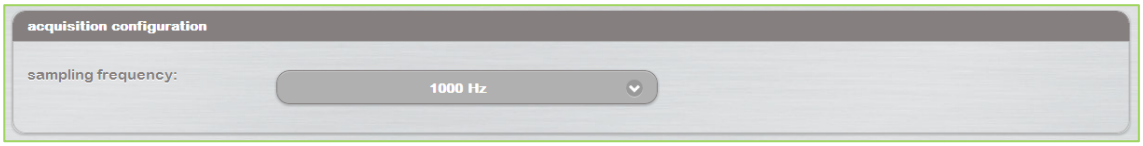

Figure 4.9: Configuration page for acquisition. Section for acquisition configuration.

Sampling frequency: Number of samples *per* second. Possible values are 1, 10, 100 and 1000 Hz.

1.1.4. Channel configuration

Whenever a device is selected for acquisition, its channel configuration is presented for editing. Each device has its own "channel configuration memory", so you don't need to worry about reconfiguring a device's channels after you de-select and re-select it.

Figure 4.10: Configuration page for acquisition. Section for channel configuration.

BITalino devices have 6 analog channels that may be used to acquire biosignals; select which ones you would like to acquire from. Set the labels (the channel's name tag) in the input boxes and set the sensors using each channel's respective combo box. As a sensor, it is possible to select one of the following: CUSTOM, ECG, EMG, EDA, ACC, LUX and ABAT. By selecting each one (except CUSTOM), the respective conversion formula will be applied to the signal. CUSTOM allows you to configure the conversion formula by clicking

and defining the formula's offset, gain and unit (*Figure 4.11*). The conversion parameters are saved for each channel of each device, so there is no need in redefining them.

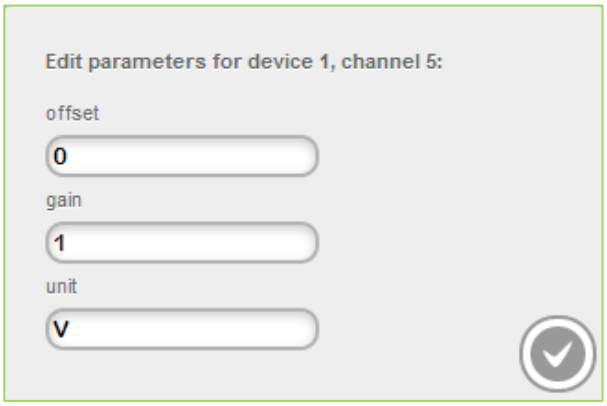

Figure 4.11: Configuration page for acquisition. Section for channel configuration. Pop-up for customizing a channel's conversion formula.

BITalino has 4 digital outputs that may be defined by toggling it on/off while in the configuration page. It is also possible to toggle each one of them in real-time, while in Acquisition mode.

5. Visualization

The Visualization page allows you to view a previously acquired signal by opening its respective file, created during acquisition. To change which file is being open, change it in the configurations (See *5.2 Visualization Configuration*)

5.1. Visualization Page

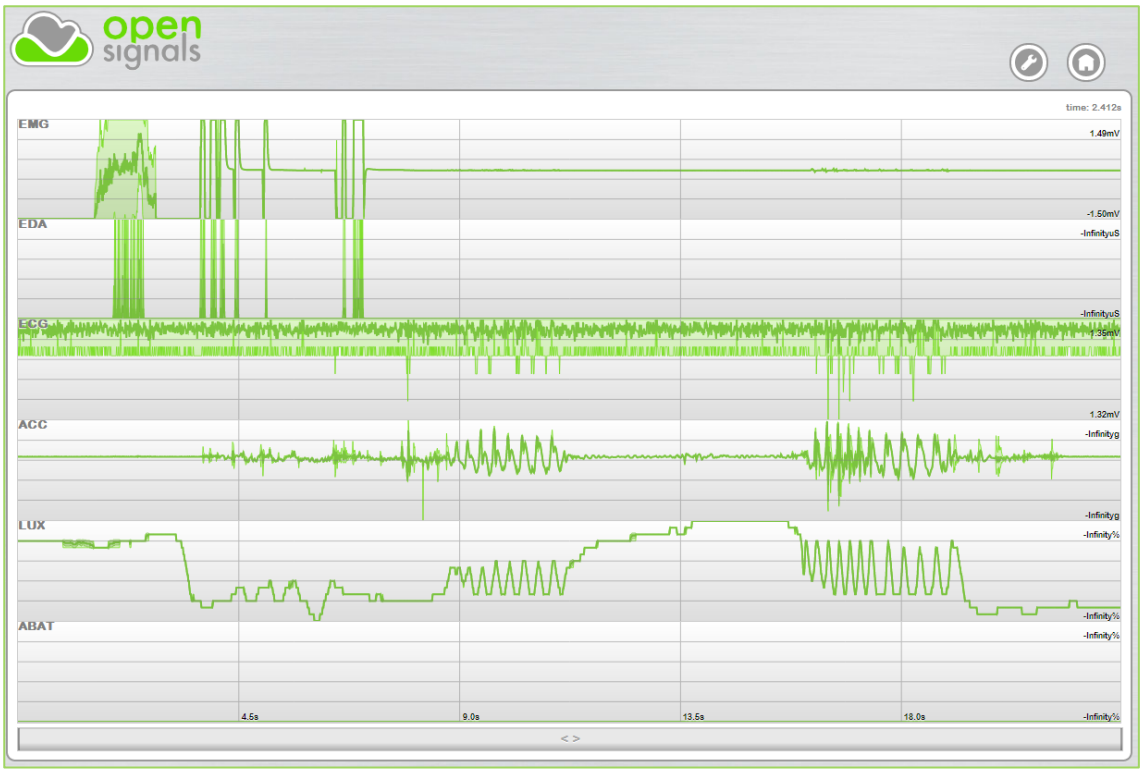

Figure 5.1: Visualization page.

The key mapped shortcuts and page buttons are explained below:

Double click channel: Vertically expands the channel.
(Keyboard) + : Zooms in all channels.
(Keyboard) - : Zooms out all channels.
(Keyboard) [1 – 8] : Fades in/out channel [1 – 8].

Button	Description
	Home button: Redirects to the main page.
	Configuration button: Redirects to configuration page for visualization.

5.2. Visualization ConfigurationPage

This page allows you to select a file from your local file system.

Files under the HDF5 format (.h5 extension) are ready to open. Simply select which channels are to be displayed and open the file. You will be redirected to the Visualization Mode using the selected file (*Figure 5.2*).

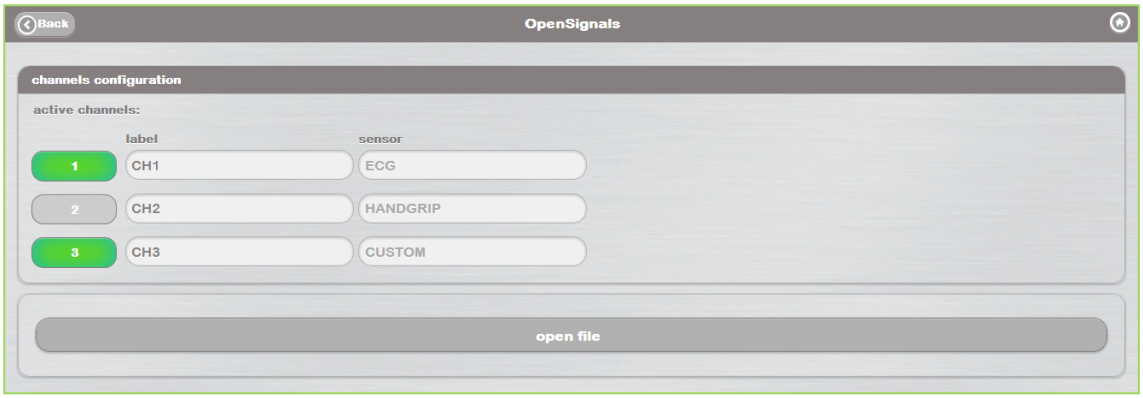

Figure 5.2: Channel selection for visualization of a previous acquisition file (.txt).

Files under the Text format (.txt extension) must undergo a small conversion step into HDF5 format. The new .h5 file is created under the same directory but it has no additional metadata regarding channel settings (See *3.2 File formats*). Upon selection of the file, you may choose which channels are to be displayed and begin the conversion (*Figure 5.3*). You will be redirected to the Visualization Mode using the converted .h5 file.

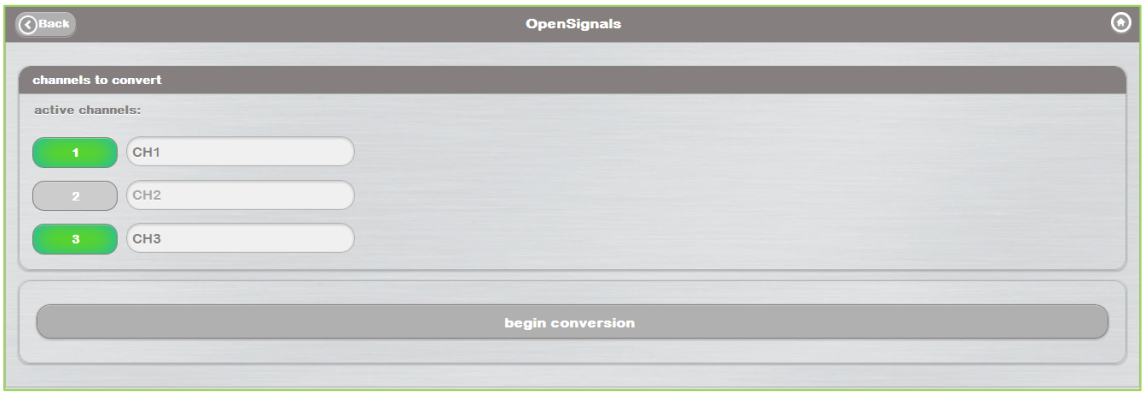

Figure 5.3: Channel selection for visualization of a previous acquisition file (.h5)